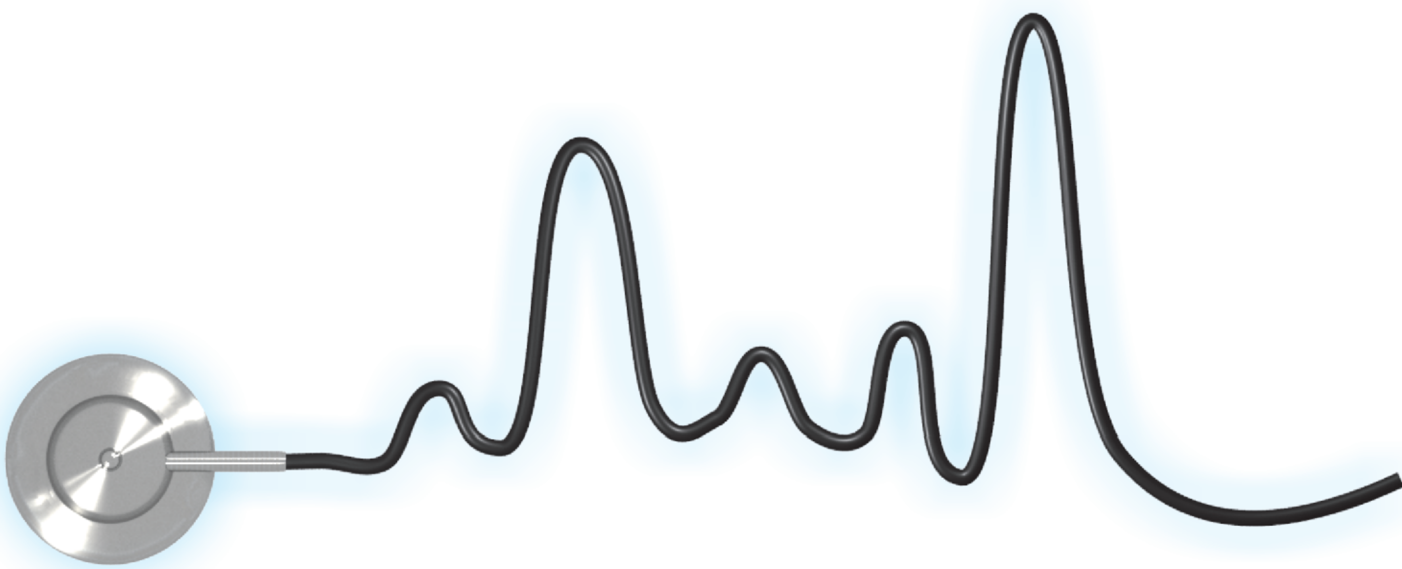
TECHINSIGHTS



COSTING ANALYSIS ON THE OMRON HEM-790ITCAN ARM CUFF BLOOD PRESSURE MONITOR

www.ubmtechinsights.com

UBM TechInsights

ABOUT THIS REPORT

The medical electronics sector is fast becoming a high-volume market for which technical innovation, cost control and IP management are competitive prerequisites. UBM TechInsights provides a range of technical analyses to help companies address product development decisions through to ensuring adequate protection of their intellectual property. This particular report provides the reader with key decision-making information like costing information on components to ensure optimal suppler agreements, and the identification of patented technologies which could be turned into valuable revenue generating licensing agreements.

The Costing Analysis on the Omron HEM-7914ITCAN Arm Cuff Blood Pressure Monitor provides readers with:

The Complete Picture - Technology and Market Assessment

- The cost analysis portion of the report provides readers with insight into costing data and overall market conditions. Armed with this information you can help to drive optimal supplier agreements, and determine whether or not a particular market is viable to enter.
- Details on the internal circuitry provides product design teams with invaluable information that can assist in new product development.

Help to Formulate an IP Strategy

- The report identifies weaknesses in your patent portfolio, and offers suggestions as to what other areas new IP should be acquired, licensed, or created.
- The report provides insight into competing devices and can show how your existing IP can be leveraged.

Leverage for IP Defense and Monetization

- This report can serve as documented “evidence of use” for unlicensed technologies.
- Help to identify IP targets in revenue generating commercially available products.

If you have questions on how you can leverage this report, or others like it, please contact Simone LeClaire at sleclaire@ubmtechinsights.com.

TABLE OF CONTENTS

LIST OF PHOTOGRAPHS

1.0 INTRODUCTION

The Omron HEM-790ITCAN Arm Cuff Blood Pressure Monitor is the most advanced arm cuff model offered by Omron for home use. It includes the following main features:

- Electric inflation
- Irregular heartbeat detection
- Morning hypertension detection
- TruRead mode that averages consecutive readings
- 2 users with 200 total data points
- PC downloading of data to Omron Health Management Software

This report includes teardown and component identification in Chapter 2 and cost analysis in Chapter 3.

2.0 TEARDOWN AND COMPONENT IDENTIFICATION

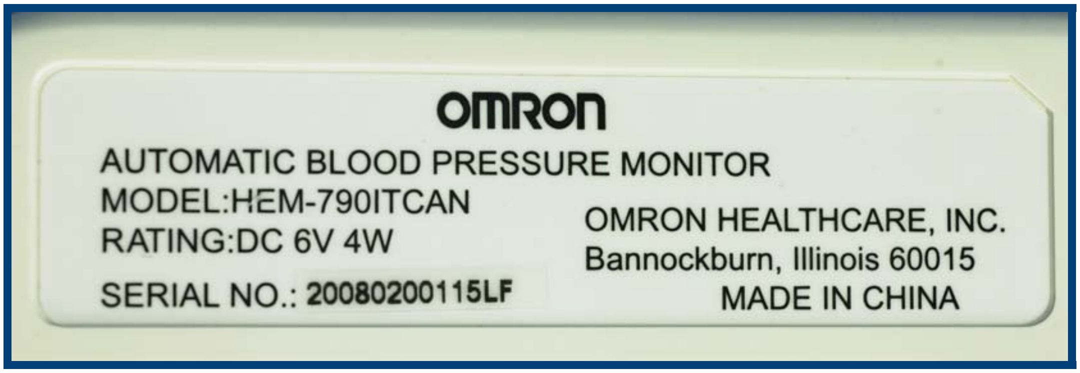
This section contains details of the teardown and identification of the main components.

2.1 PRODUCT IDENTIFICATION

Photographs 2.1.1 to 2.1.4 show the front and back of the monitor along with the identification tag and all of the items shipped with the monitor.

Photograph 2.1.1: Package Front

Photograph 2.1.2: Package Back

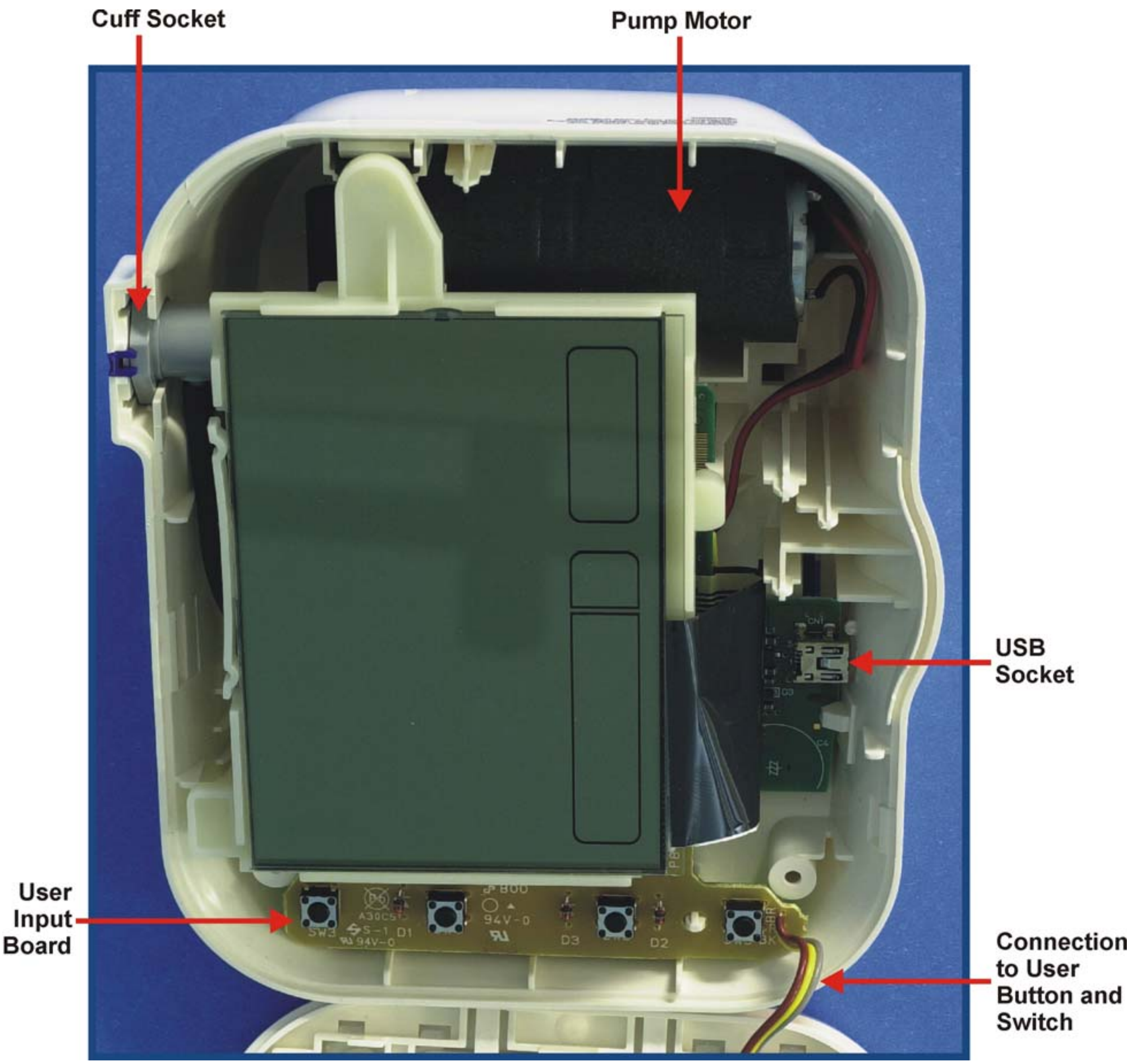


Photograph 2.1.3: Package Identification Tag

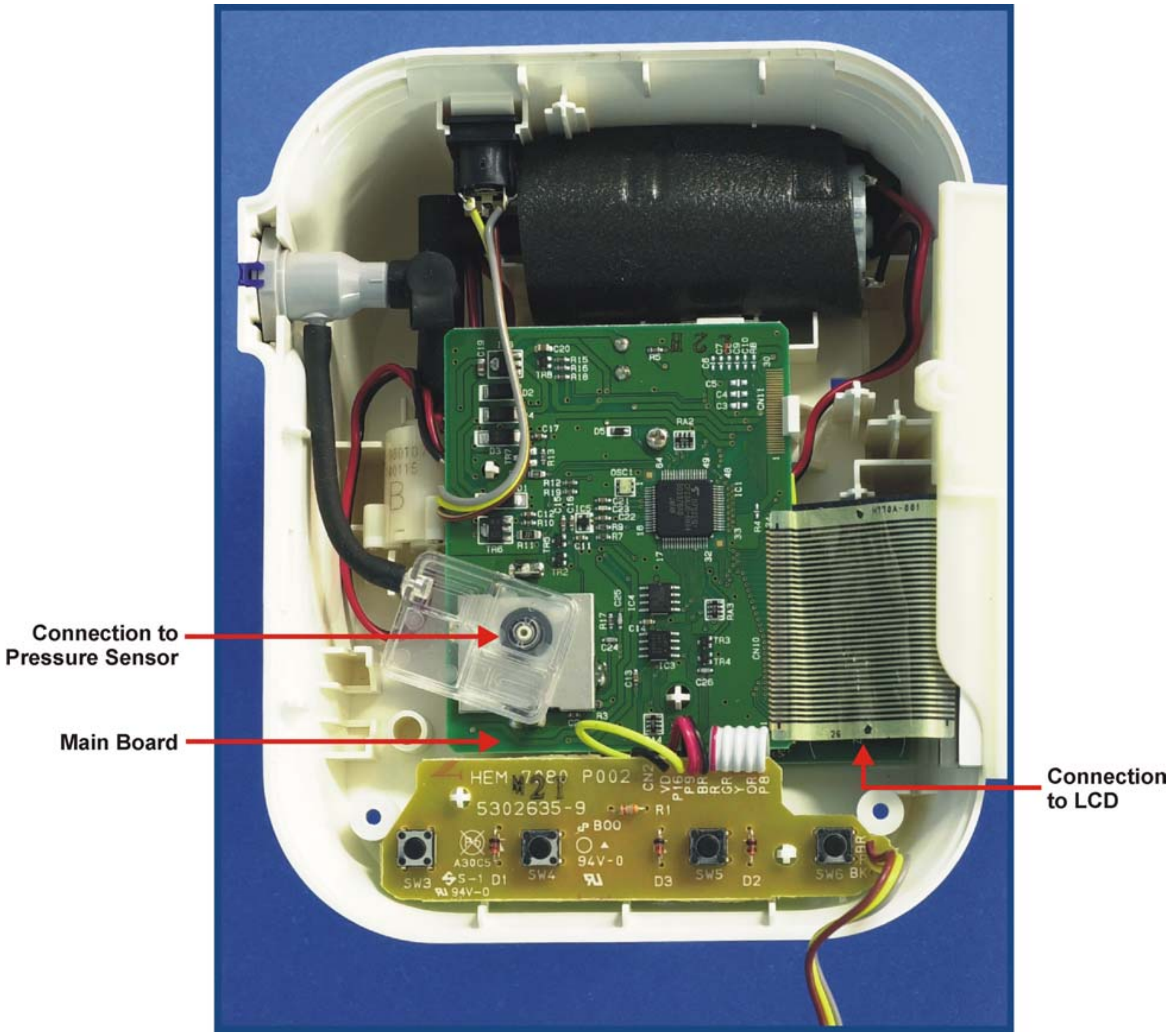
Photograph 2.1.4: All Items

2.2 MONITOR TEARDOWN

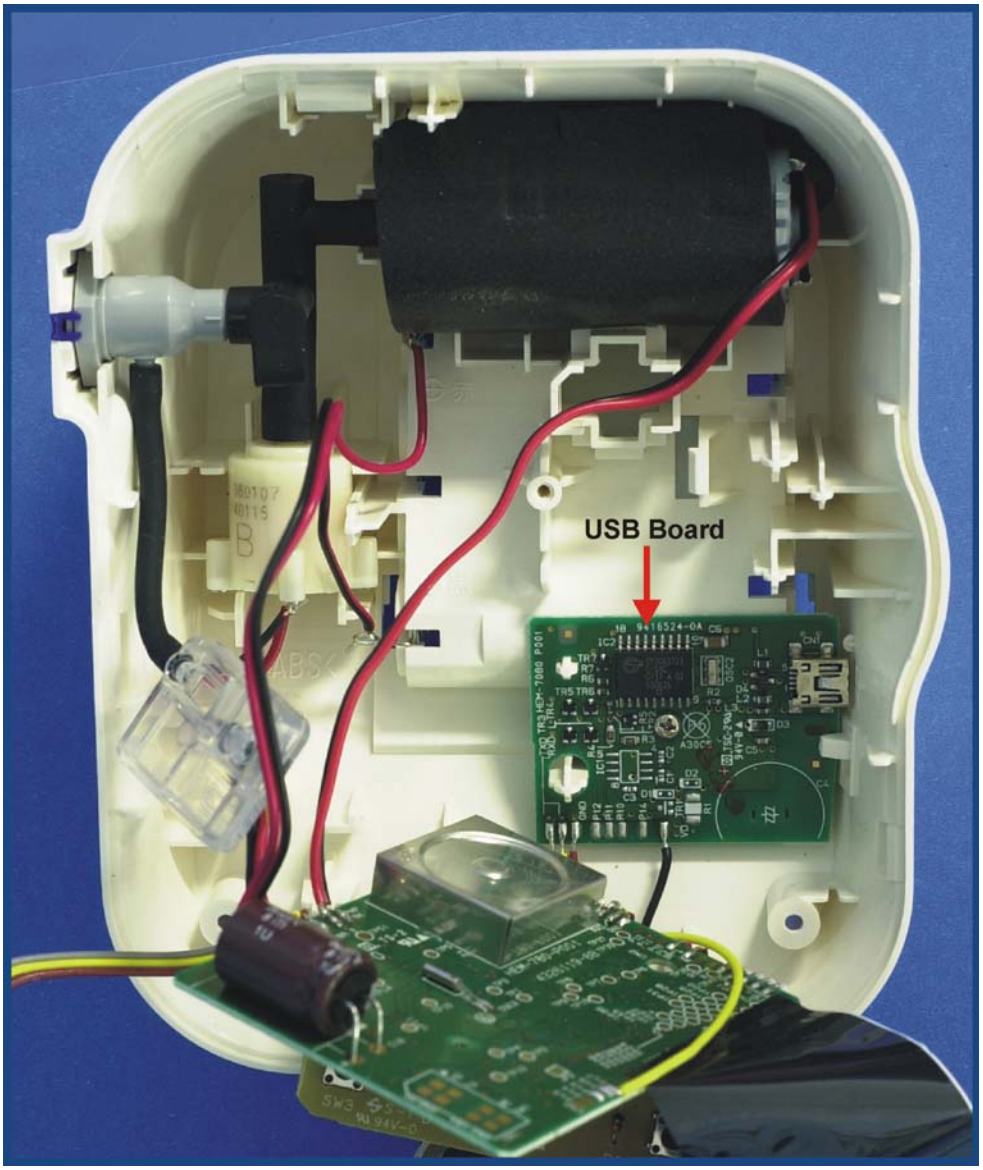
The stages in the teardown are shown in the following photographs.



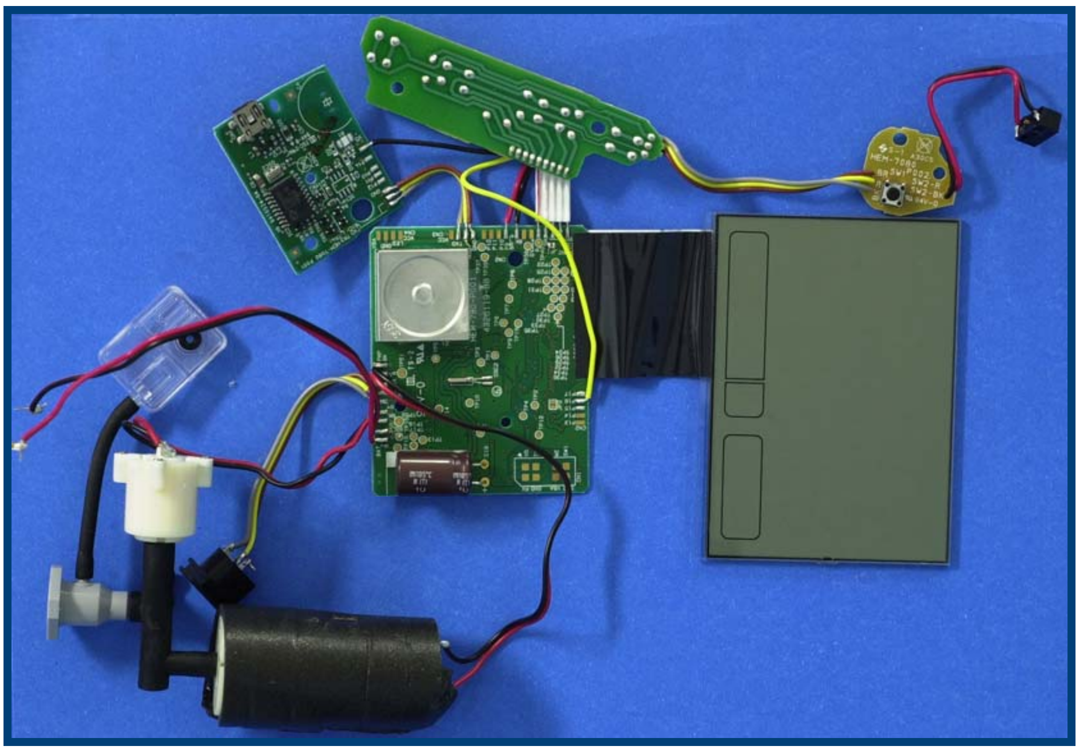
Photograph 2.2.1: Front Cover Removed



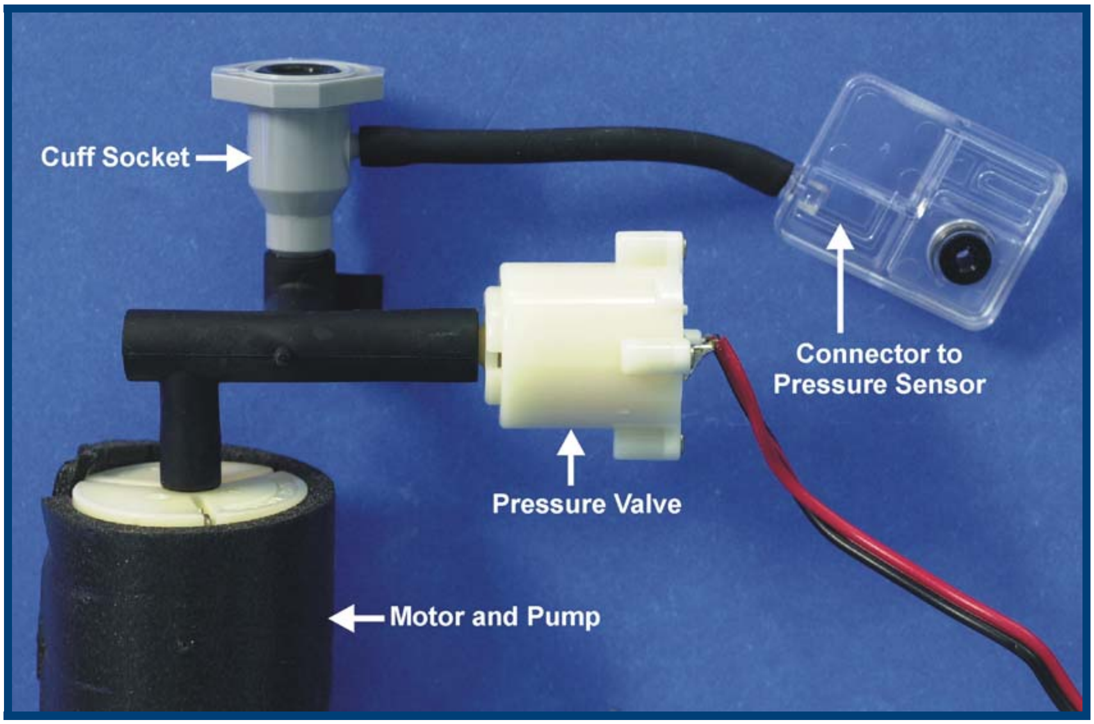
Photograph 2.2.2: Display Removed



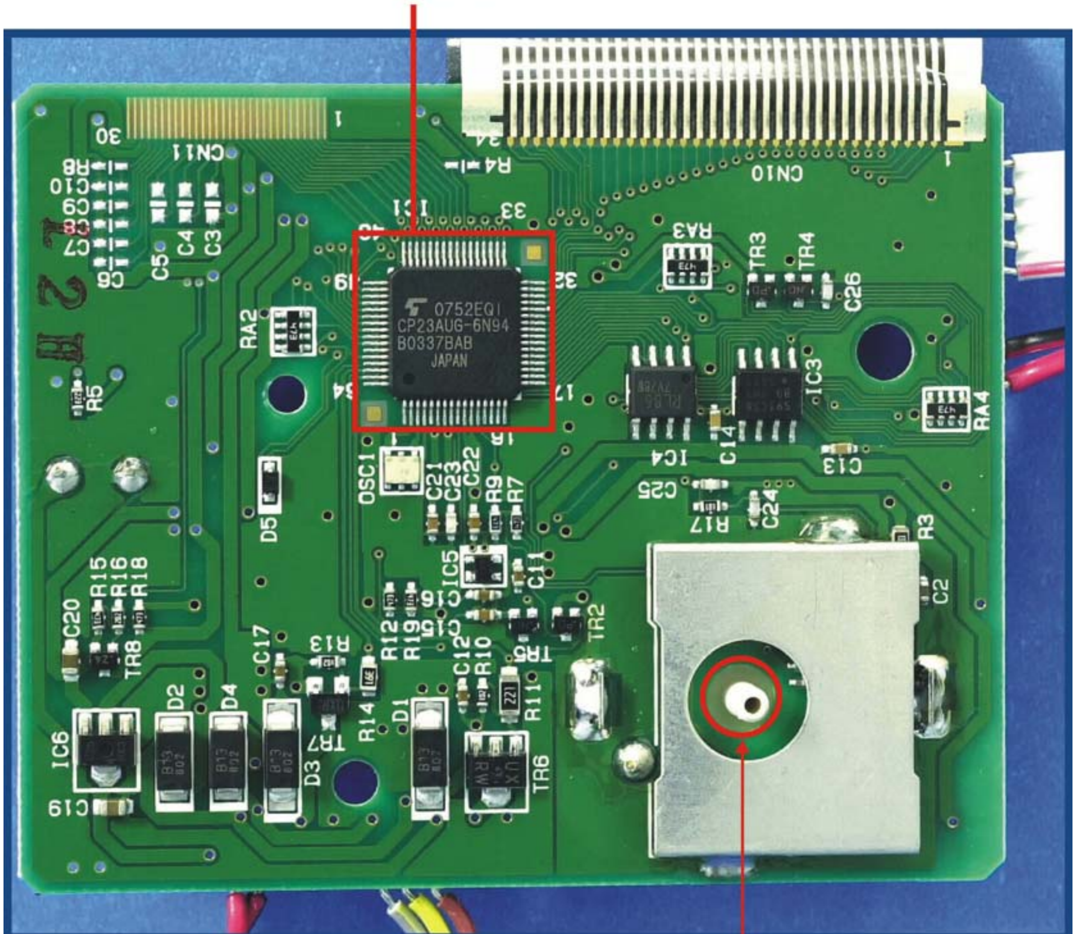
Photograph 2.2.3: Main Board Removed



Photograph 2.2.4: All Electrical Components

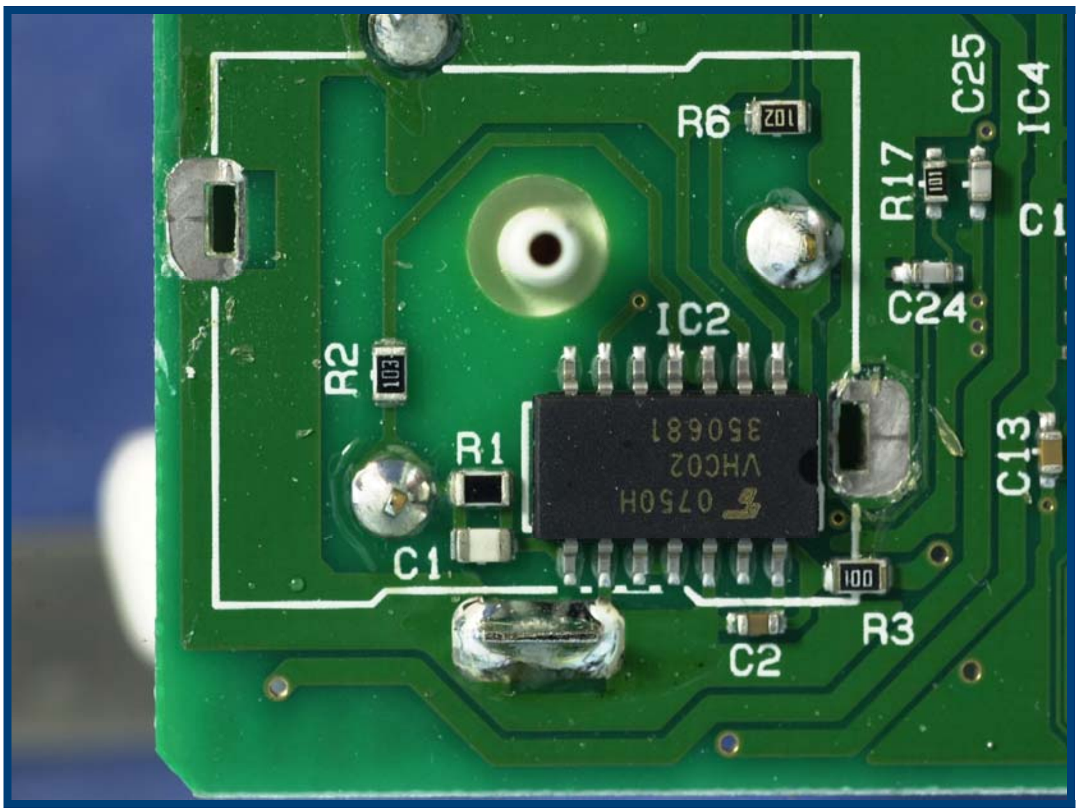


Photograph 2.2.5: Pump Assembly

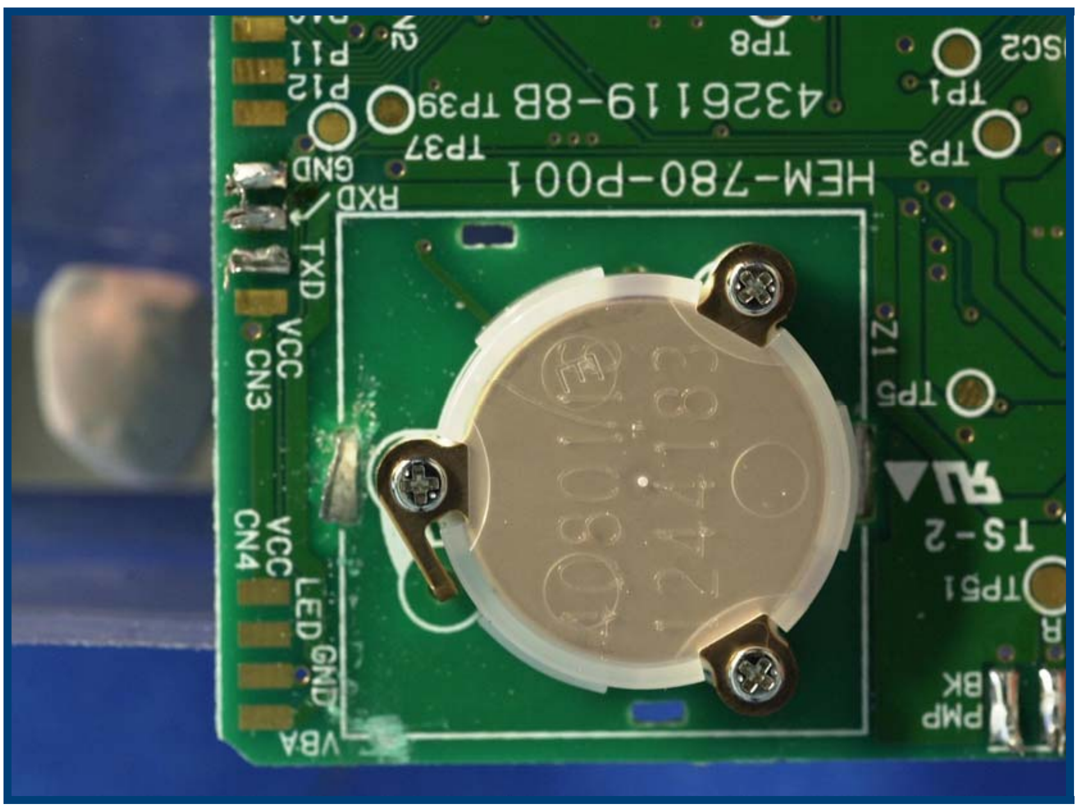


Photograph 2.2.6: Main Board Front

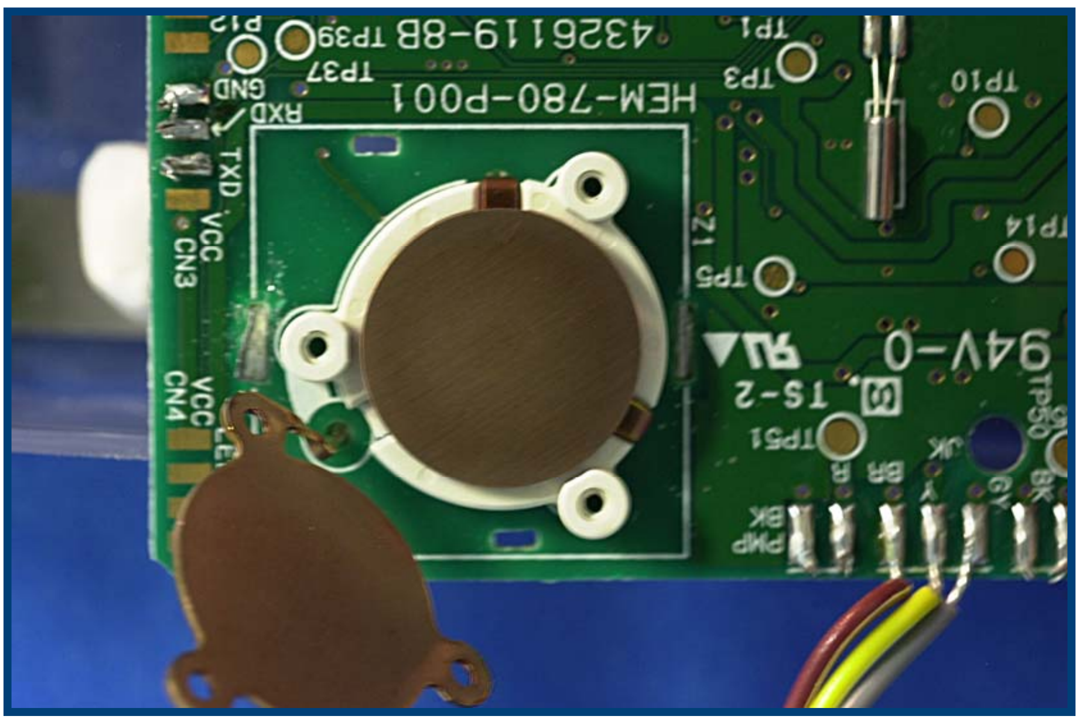
Photograph 2.2.7: Main Board Back



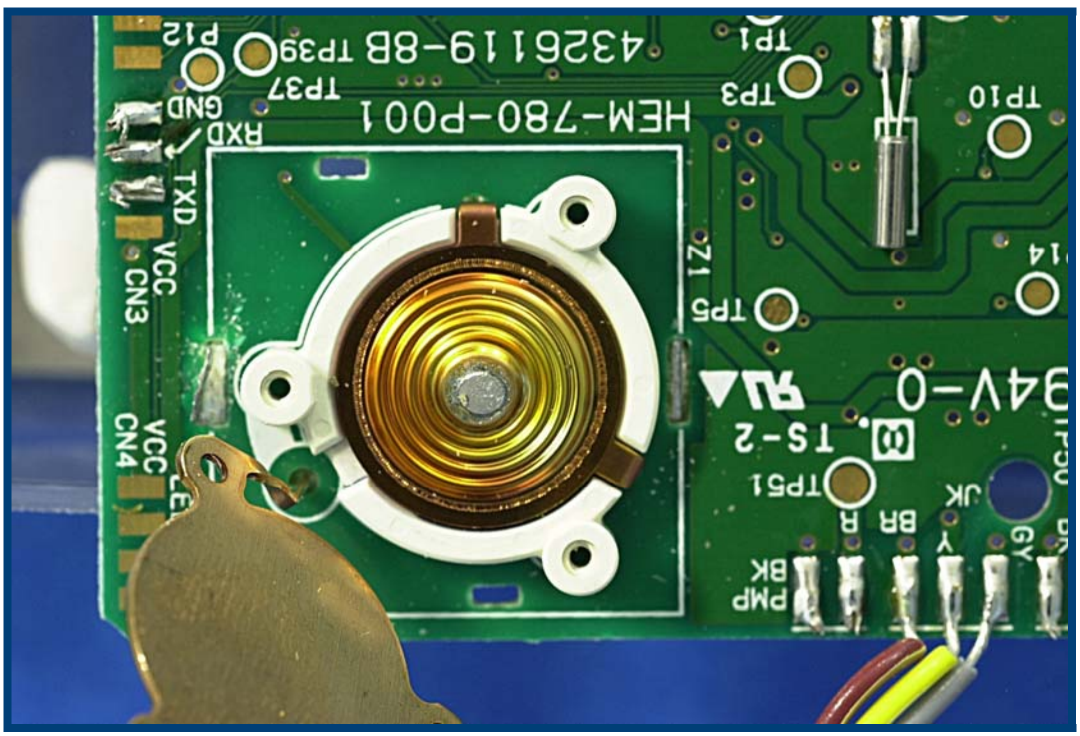
Photograph 2.2.8: Pressure Sensor Connector Cover Removed



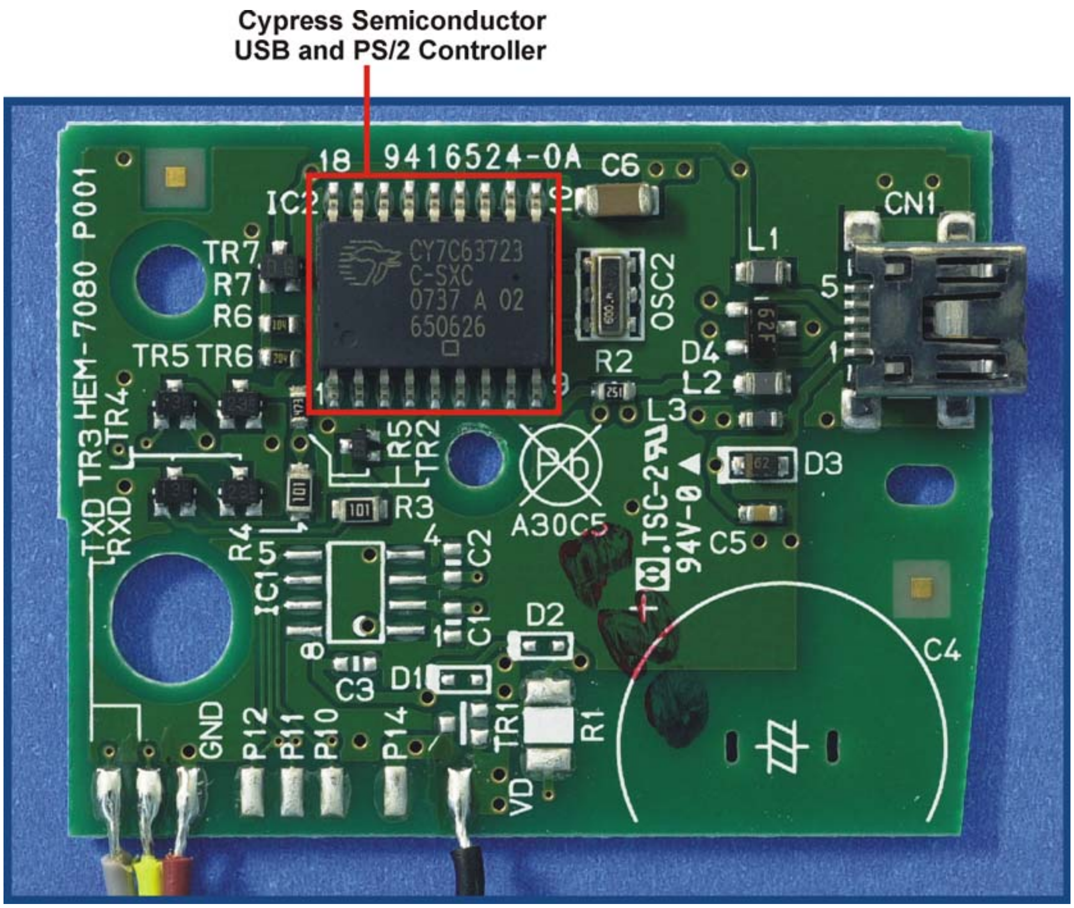
Photograph 2.2.9: Pressure Sensor Teardown 1



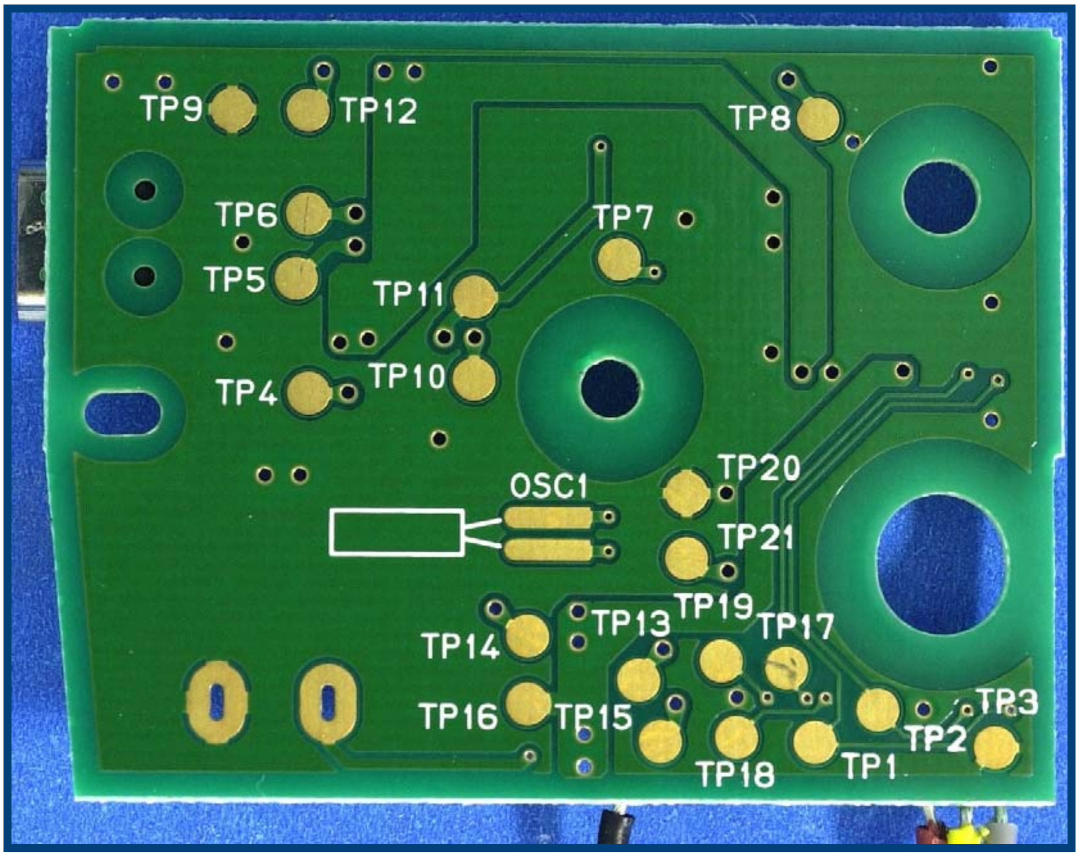
Photograph 2.2.10: Pressure Sensor Teardown 2



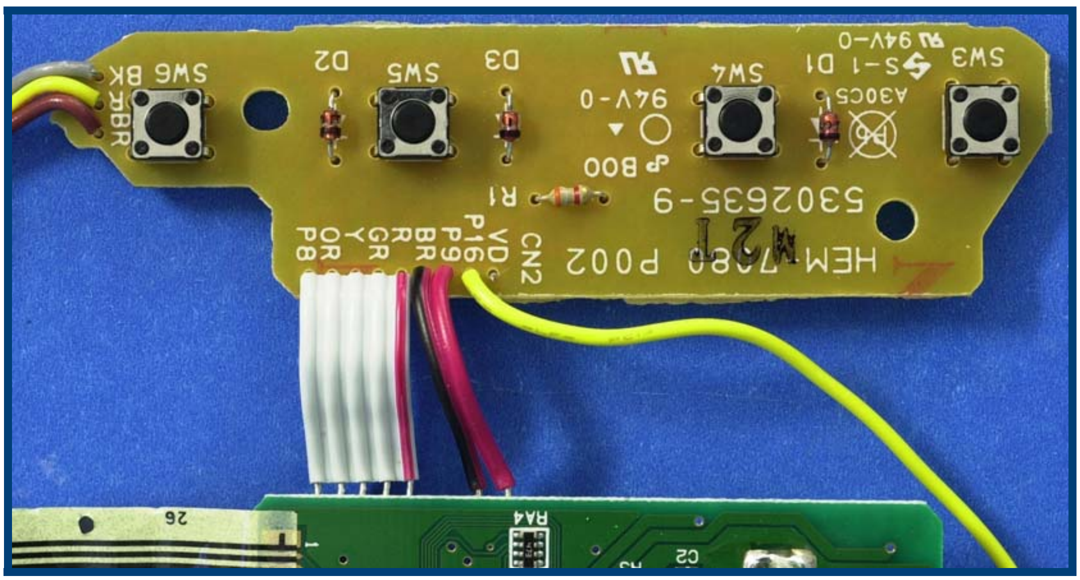
Photograph 2.2.11: Pressure Sensor Teardown 3



Photograph 2.2.12: USB Board Front



Photograph 2.2.13: USB Board Back



Photograph 2.2.14: User Input Board Front

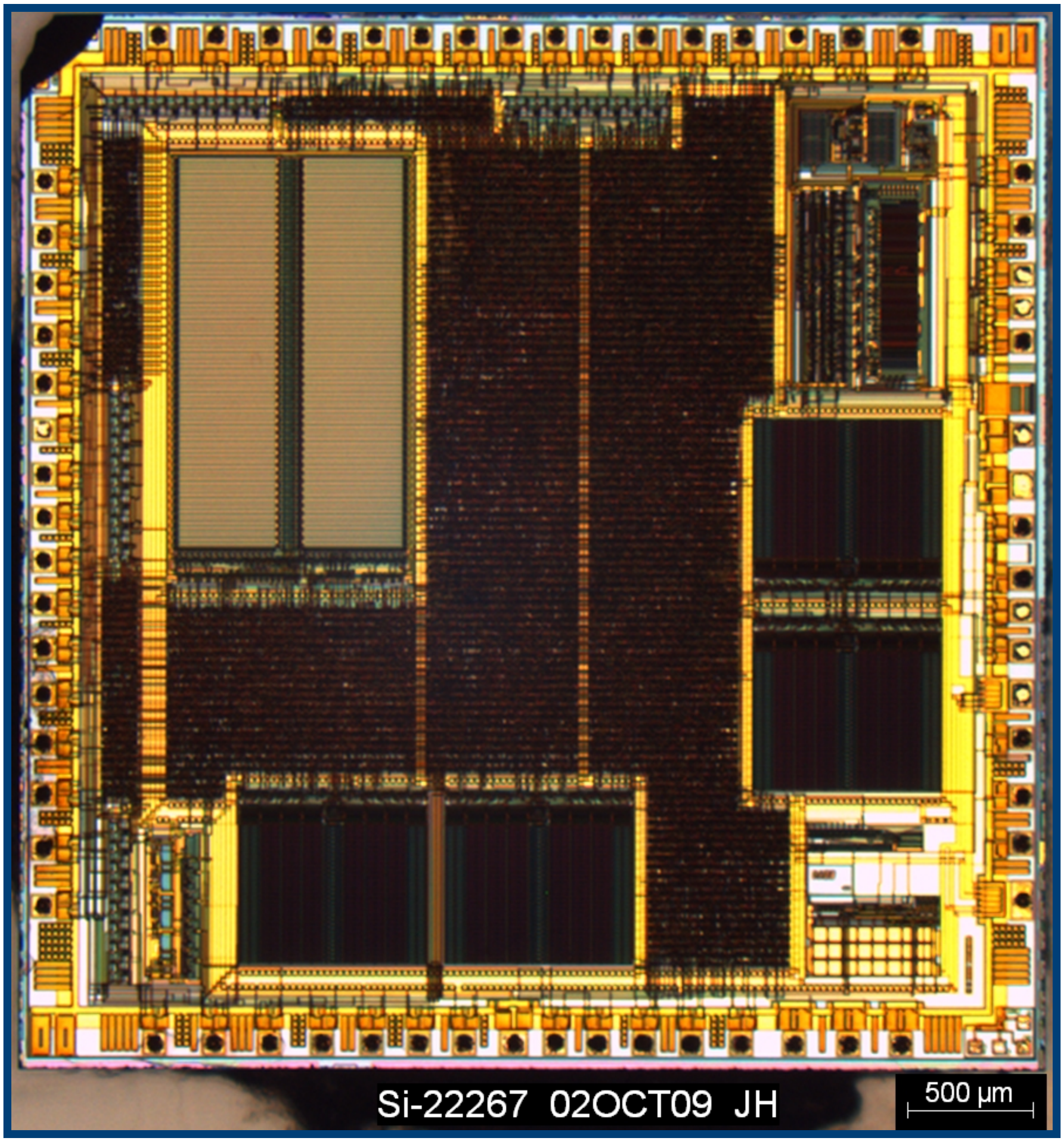
2.3 MAIN IC IDENTIFICATION

The main IC's within the monitor are:

Toshiba 8-bit microcontroller (see Photographs 2.3.1 to 2.3.4) with the following main features:

- 48 Kbytes ROM
- 2Kbytes RAM
- Multiply-Accumulate Unit (MAC)
- LCD driver : 32 seg.×4 com.
- 10-bit AD converter : 8 channels
- UART : 1 channel
- SIO : 1 channel
- 8-bit timer : 4 channels
- 18-bit timer : 1 channel

Photograph 2.3.1: Toshiba TMP86CP23AUG Microcontroller Package Top



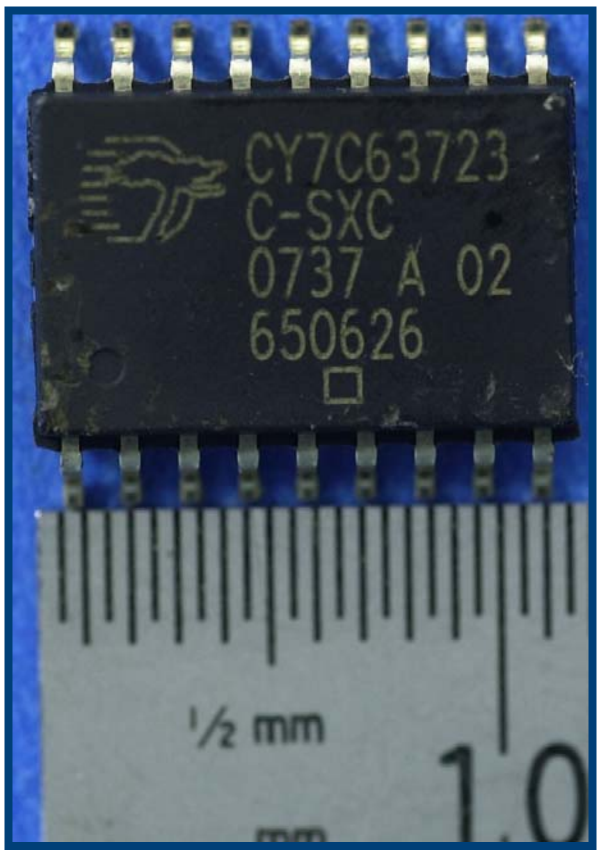
Photograph 2.3.2: Toshiba TMP86CP23AUG Microcontroller Die

Photograph 2.3.3: Toshiba TMP86CP23AUG Microcontroller Die Mark 1

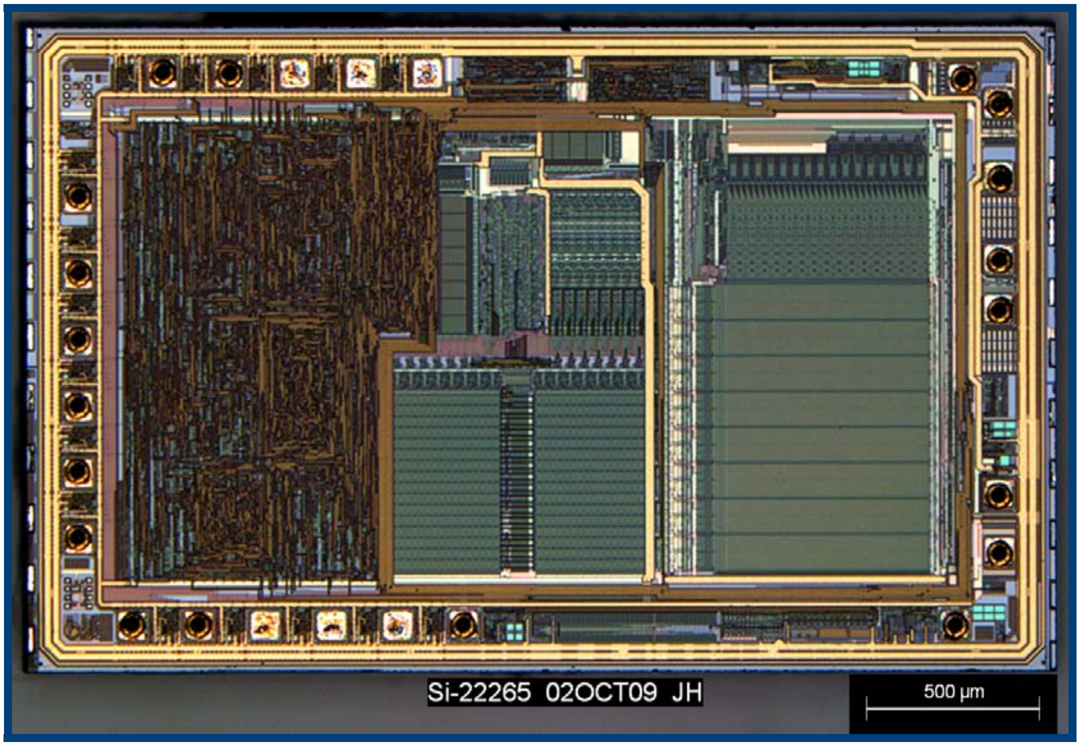
Photograph 2.3.4: Toshiba TMP86CP23AUG Microcontroller Die Mark 2

Cypress Semiconductor enCoRe™ USB Combination Low-Speed USB and PS/2 Peripheral Controller (see Photographs 2.3.5 to 2.3.8) with the following main features:

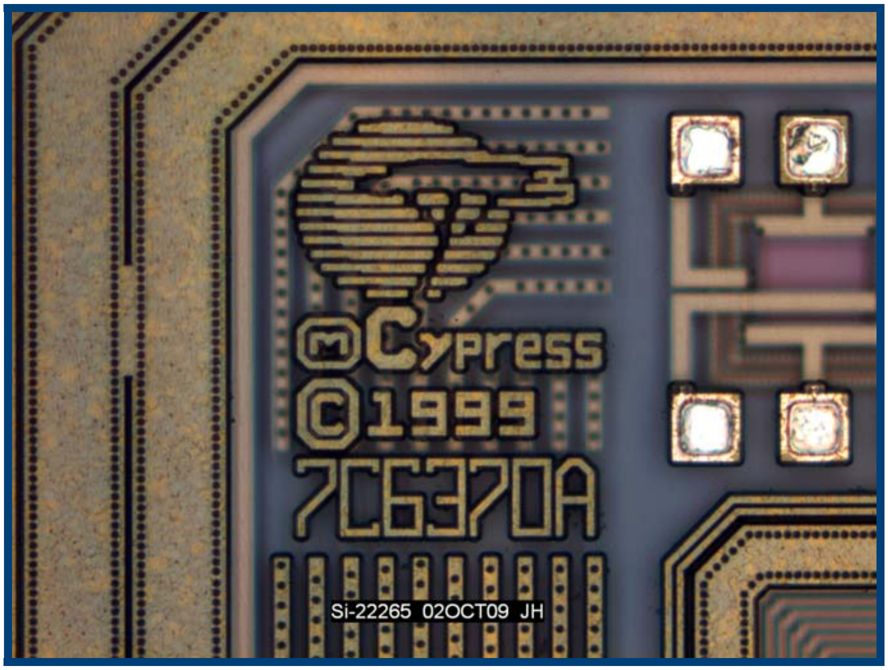
- Conforms to USB Specification, Version 2.0
- Conforms to USB HID Specification, Version 1.1
- Supports 1 Low-Speed USB device address and 3 data endpoints
- Integrated USB transceiver
- 8-bit RISC microcontroller (12-MHz internal CPU clock)
- 256 bytes of RAM
- 8 Kbytes of EPROM
- Up to 16 versatile General Purpose I/O (GPIO) pins
- SPI serial communication block



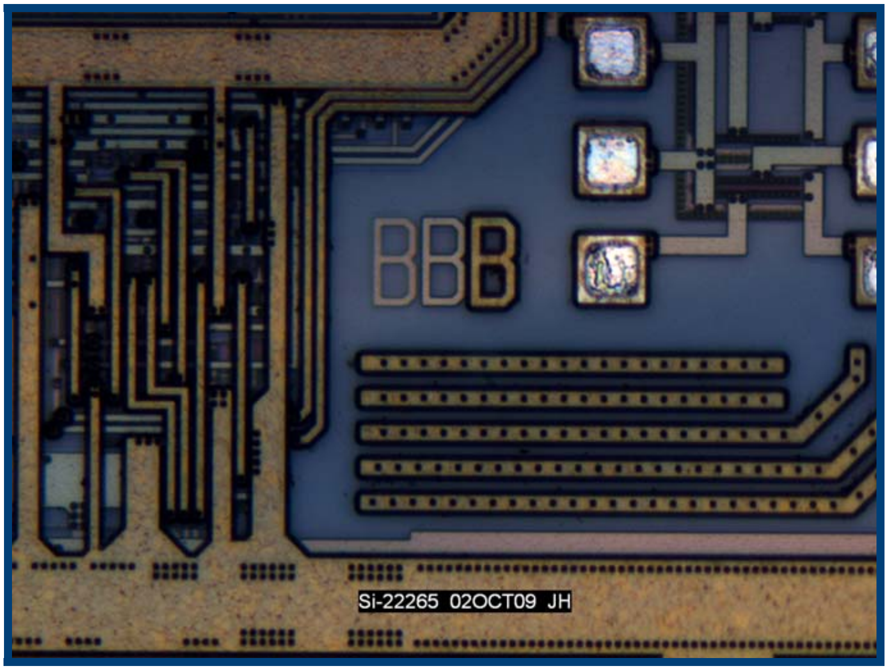
Photograph 2.3.5: Cypress Semiconductor CY7C63723 USB and PS/2 Controller Package Top



Photograph 2.3.6: Cypress Semiconductor CY7C63723 USB and PS/2 Controller Die



Photograph 2.3.7: Cypress Semiconductor CY7C63723 USB and PS/2 Controller Die Mark 1



Photograph 2.3.8: Cypress Semiconductor CY7C63723 USB and PS/2 Controller Die Mark 2

3.0 COST ANALYSIS

The following tables summarize the cost analysis for each of the main sections of the monitor as well as the overall cost for the monitor.

Major ICs

	BRAND	PN	DIE SIZE	TECH	FUNCTION	COST
MB - IC1	Toshiba	CP23AUG-6N94	4.2x4.1	CMOS	Microcontroller	$1.57
USB - IC2	Cypress		3.0x1.9	CMOS	USB Controller	$0.54
MB - IC2	Toshiba	VHC02	1.2x.9	CMOS	Quad 2-In NOR	$0.17
MB - IC4	?	RL86	2.0x1.6	CMOS	?	$0.22
MB - IC3	SII-IC	S93C56	1.5x1.1	CMOS	EEPROM	$0.15
MB - IC5	?	B8R			4 Pin SOP	$0.06
MB - IC6	?	CXB GZ3			4 Pin SOP	$0.08

Substrates

	LENGTH	WIDTH	SQ CM	LAYERS	COST
Main Board	75	60	45	2	$0.44
Four Button Board	87	24	21	1	$0.11
One Button Board	28	24	7	1	$0.04
USB Board	48	36	17	2	$0.17

Modules

	BRAND	PN	QUANTITY	UNIT COST	COST
Pump + Motor			1	$6.00	$5.00
Pressure Valve			1	$1.25	$1.25
SMT Switch			5	$0.08	$0.40
Switch	Omron	P53A02R	1	$0.10	$0.10
Oscillators			3	$0.22	$0.66
Pressure Sensor			1	$0.85	$0.85

Discretes

	QUANTITY	UNIT COST	COST
Transistors	15	$0.030	$0.45
Pkg diodes	5	$0.030	$0.15
Glass diodes	4	$0.040	$0.16
Capacitors	18	$0.004	$0.07
Electrolytic Cap	1	$0.150	$0.15
Resistors	23	$0.001	$0.02
Resistor array	3	$0.003	$0.01
Inductors	3	$0.003	$0.01

Connectors

	QUANTITY	UNIT COST	COST
USB Connector	1	$0.07	$0.07
DC Connector	1	$0.12	$0.12
Cables	10	$0.03	$0.30
Battery Contacts	5	$0.04	$0.20

Subsystems

	QUANTITY	UNIT COST	COST
4.5 inch LCD Display	1	$3.75	$3.75

Main Non-Electronics

		QUANTITY	UNIT COST	COST
Labels	Plastic, Die-Cut, Printed	6	$0.14	$0.84
Base	ABS, 110.3grams. 152x130x76mm	1	$1.75	$1.75
LCD Cover	LCD Window, 50 gram,Painted Printed,	1	$2.05	$2.05
Front	ABS, 34grams. 154x132x32mm	1	$0.46	$0.46
Internal Support	ABS, 19 grams, 121x87x24mm	1	$0.26	$0.26
Battery door	ABS, 10 grams, 76x65x4mm	1	$0.14	$0.14
Tubing and fittings	Rubber, Plastic	6	$0.05	$0.30
Feet	Rubber	4	$0.01	$0.04
Spring		1	$0.07	$0.07
Metal Cover	Aluminum, 25x25x8mm	1	$0.12	$0.12
Foam		1	$0.05	$0.05
Screws		6	$0.01	$0.06
Cuff	Cuff, tubing, plastic connector	1	$5.00	$5.00
Miscelleous	Buttons, Covers, Slider	11	$0.08	$0.88

FINAL ASSEMBLY & TEST	PARTS	STEP	SECONDS	COST
	66	211	718	$0.85

Accessories

	QUANTITY	UNIT COST	COST
AC Adapter	1	$2.10	$2.10
USB Cable	1	$0.40	$0.40
Batteries	4	$0.25	$1.00
Documentation	1	$0.65	$0.65
Software (CD)	1	$0.25	$0.25
Case	1	$1.05	$1.05
Package	1	$0.75	$0.75

TOTAL COST	$36.34
AVERAGE RETAIL PRICE	$85.00
GROSS MARGIN	57%

Cost Estimation Process

Cost modeling is tricky business. Multiple variables affect the actual production costs a manufacturer will experience, including development expenses, unit volumes, supply-and-demand in component markets, die yield-curve maturity, OEM purchasing power, and even variations in accounting practices. Different cost modeling methods employ different assumptions about how to handle these and other variables, but we can identify two basic approaches: that which seeks to track short-term variations in the inputs to the production process, and that which strives to maintain comparability of the output of the model across product families and over time.

Our philosophy in cost modeling is to emphasize consistency across products and comparability over time, rather than to track short-term fluctuations. During the past eight years, we have developed an estimation process that, while necessarily lacking an insider's knowledge of the cost factors that impact any one manufacturer, is reasonably accurate in its prediction of unit costs in high-volume production environments. We do not claim that the model will produce the "right" answer for your firm's environment.

Our estimation process decomposes overall system cost into three major categories: Electronics, Mechanical, and Final Assembly. We begin by creating a complete electronics bill-of-materials (BOM). Each component from the largest ASIC to the smallest discrete resistor is entered into a BOM table with identifying attributes such as size, pitch, I/O count, package type, manufacturer, part number, estimated placement cost, and die size (if the component is an IC). Integrated circuit costs are calculated from measured die area. Using assumptions for wafer size, process type, number of die per wafer, defect density, and profit margin in combination with die area, an estimate of semiconductor cost is derived. Costs for discrete components and interconnect are derived from assumption tables which relate BOM line items to specific cost estimates by component type and estimates for part placement costs are included. For LCD display costs, we employ a model which tabulates expected cost from measurements of glass area, LCD type, and total pixel resolution. When market costs are available from alternative sources, LCD panel costs are taken from and referenced to these sources.

Costs of non-electronic components such as molded plastic enclosures and metallic components are measured in terms of weight, size, thickness, type of material, and complexity to arrive at their estimated cost. Other system items such as optics, antennae, batteries and displays are costed from a set of assumption tables derived from a combination of industry data, average high volume costs, and external sources. For final assembly, we re-build the torn-down product, tabulating stepwise assembly times as the reconstruction proceeds, to reach a total assembly time. Using a labor rate assumption for the country of origin, we then calculate final assembly cost.

The three major categories for system cost contributors can be broken down into the subcategories of ICs, other electronics parts, displays, batteries (as appropriate), camera modules, electronics assembly, non-electronic elements, and final assembly. By adding the cost estimates for each of these subcategories, an overall estimated cost is derived for the system under evaluation. Product packaging and accessories (CDs, cables, etc.) are also documented and estimated for their contribution to total cost as appropriate.

We believe our cost estimates generally fall within ±15 percent of the “right answer,” which itself can vary depending on the market and OEM-specific factors mentioned earlier. While the this cost model is imperfect, it yields important insights into technology and business dynamics along with good first-order contributions to system cost by component type. Additionally, the consistency of approach and gradual modification to assumptions (smoothing out frequently-shifting pricing factors) hopefully yields a credible, but user-modifiable, view of OEM high volume cost-to-produce.